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ABSTRACT

Two studies assessed the impact of short-term memory on English as a Second Language learning. The first involved 20 graduate students at a Taiwanese university, who were randomly divided into treatment and control groups. It investigated differences in the performance of phrase recollection when the information was chunked versus unchunked. Results showed that the capacity of short-term memory could be enhanced by providing chunked information, suggesting a relationship between the capacity of short-term memory and language learning. The second study assessed the implications of the first study, investigating whether there would be a significant difference in students' recall in a word-related group, in which students were provided with an article whose vocabulary was related to a specific category, and a word-unrelated group, in which students were provided an article in which the vocabulary presented did not focus on a certain category. Results indicated that the difference between the word-related and word-unrelated groups was significant. The more words students recalled in class, the more words they could memorize after class. Overall, the research found that there was a strong relationship between short-term memory and language learning. (Contains 21 references.) (SM)

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The Role of Short-term Memory on Language Learning

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Abstract

Experiment 1 investigates whether a difference exists in performance of phrases recalled depending on information is chunked or un-chunked. Twenty graduate students with different majors participated in the study. The result shows that the capacity of short-term memory can be enhanced through providing information chunked. The finding also leads to a discussion of the relationship between the capacity of short-term memory and language learning. Experiment 2 is conducted to investigate the implication of experiment 1, that is, an article whose vocabulary presented is related to a specific category will enhance the capacity of short-term memory of the students in class. Twenty students in the remediation class of English participated in the study. The result shows that vocabulary of an article belongs to a certain category can help subjects recall what vocabulary they have learned in class. Furthermore, the result seems to infer that more words the students recalled in class, more words they can memorize after class.

Introduction

In the field of cognition, one of the most important and interesting topics is concerning the human memory. A number of theories of memory also have been proposed to illustrate the features of short –term (e.g., Broadbent 1958; Waugh & Norman 1965; Kintsch & van Dijk, 1978) and long-term memory (Anderson, 1983; Anderson & Lebiere, 1998; Gillund & Shiffrin, 1984) in cognitive and educational psychology over the past few decades. Besides, relevant research investigating the relationship between the human memory and learning such as, recall (Bower, Clark, Lesgold & Winzenz, 1969), meaningful elaborations on memory (Kolers, 1979; Slamecka & Graf, 1978), and intentional versus incidental learning (Hyde & Jenkins, 1973; Nelson, 1976) are also conducted. Furthermore, some researchers (Lightbown & Spada, 1999) even proposed that memory is one of factors which can be used to predict the performance of a student's learning foreign languages. So we can find that both the Modern Language Aptitude Test (MLAT) and the Pimsleur Language Aptitude Battery (PLAB) contain one subtest used to measure the ability of memory for new words. Obviously, memory influencing on language learning actually exists. Although there are a lot of studies investigating the relationship between learning and memory, and also some topics specifically focus on language learning, the near or direct research on the relationship between short-term memory and language learning is seldom carried out. Therefore, the purpose of the present study is to investigate the relationship between short-term memory and language learning and to provide pedagogical implications in language learning.

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Theory of Short-Term Memory

As to the "memory system", according to Ashsraft (1994), there are many other synonyms for short-term memory (STM), such as primary memory, elementary memory, immediate memory, short-term store (STS) and working memory. In the theory of memory system, short-term memory is located between sensory store and long-term memory in the information processing. From the literal meaning, short-term memory refers that the period of information stored in the brain is short. That is, information in short-term memory is forgot easily and quickly without any further processing (Anderson, 2000). Moreover, the quick-forgetting feature is the most significant feature for short-term memory.

In fact, many researchers have examined the feature of forgetting of short-term memory through empirical studies. The following subsection reviews some research on factors affecting the forgetting of short-term memory.

Interfere. Some researchers proposed that information in long-term memory interferes with information in short-term memory. Take the most well-known experiment of "proactive interference" for instance (Wickens, 1972; Wickens, Born, & Allen, 1963). The experiment shows that when the subjects' short-term memory is tested with different words within the same category continually, the capacity of short-term memory decreases. However, if the words tested are changed to a different category, short-term memory improves. Therefore, researchers concluded that the previous words lead to the activation in long-term memory and inhibit the words on the following trial in short-term memory.

Decay. Another factor which influences the forgetting feature might be decay. In other words, forgetting results from the passage of time before testing. This concept is inferred from the Brown-Patterson task (Brown, 1958; Peterson & Peterson, 1959). In this task, subjects received a set of words, followed by an interfering activity and then recalled the original information. The findings are the duration of short-term memory is limited to 20 seconds or even less and with the time increasing, less and less information is held in short-term memory.

Displacement. A different point of view concerning the forgetting in short-term memory is that forgetting occurs through displacement, that is, old information would be pushed out from short-term memory when it was displaced by new one (Barsalou, 1992). Similarly, Waugh and Norman (1965) suggested that the prediction of short-term memory for a certain chunk was based on the numbers of chunk following the original chunk, not based on the duration of the test chunked in short-term memory. Thus, the main reason for causing the forgetting in short-term memory is that how many chunks displace the tested chunk after it is encoded.

Capacity. Many researchers stated that short-term memory has limited capacity of storing information. That is, less information can be encoded, held, and reported immediately and accurately after being put into short-term memory system. Miller (1956) created the expression, "the magic number seven, plus or minus two, " to describe the severe

limitation on storing information of short-term memory. Consequently, the limited capacity is the bottleneck in our information processing system (Ashcraft, 1994).

In short, from the review of short-term memory above, we find that many researchers believe that inference, decay, displacement, and capacity all contribute to the forgetting in short-term memory. Indeed, all the factors illustrate evidently the existence of the limitation on the amount of information received, processed, and stored in short-term memory.

On the other hand, although researchers have proposed much evidence on the limitation of short-term memory for storing information, Miller (1956) pointed out that people can extend the limitation of short-term memory through grouping or chunking information, for richer items are much easier to be remembered. As for grouping or chunking, a technical term, recording, can be used to describe the process (Ashcraft, 1994). Specifically, two reasons can be used to explain the power of recording. One is that recording can reduce the loading of short-term memory by decreasing the number of units and increasing the richness of each unit (Ashcraft, 1994). The other is that when you group all the elements into several large units, each unit containing related elements, the representation of correspondence of each large unit in your long-term memory will be activated (Barsalou, 1992). Also, the information stored in short-term memory is about five units and the amount of information depends on how large the unit is. Thus, people can augment their capacity to increase the amount of information through recording.

Despite the benefit of the recording mentioned above, there are some conditions in the process of recording (Ashcraft, 1994). First, recording occurs in the condition of when sufficient time is employed to group information. Second, people have to pay attention to the nature of grouping of information while it comes. Third, well-established chunks of knowledge in long-term memory are available before recording (Barsalou, 1992).

Purpose of the Study

To summarize, the cognitive literature reviewed above has indicated that most of the studies investigated in the field of short-term memory are the capacity, factors affecting storage and so on. Furthermore, all the results of those research presented often only show that the descriptive features of short-term memory. As for the implications of the results for language learning, researchers seldom mentioned or provided. Further research is still needed in the field of human memory to investigate the relationship between short-term memory and language learning. Therefore, the present study consists of two experiments focusing on short-term memory. The first is to replicate the previous study on the capacity of short-term memory. And then in order to investigate the relationship between short-term memory and language learning, experiment 2 is carried out and wishes to find out some implications applied in language learning.

Experiment 1

Method

Participants. A total of 20 graduate students with different majors studying in a technology university in Taiwan participated in the present study voluntarily. All the subjects were randomly divided into two groups, a Treatment Group and a Control Group.

Procedure. Subjects in the Treatment Group were presented with 20 phrases chunked in advance for 25 seconds. After subjects finished the task, they had to recall and write down what they remembered. In order to reduce subjects' unfamiliarity with language, the phrases were written in Chinese. As for the Control Group, phrases subjects received were the same with those in theTreatment Group, but arranged in random. The time given for the Control Group is also 25 seconds.

Materials. All the phrases used in the Treatment Group and Control Group were designed by the researcher (see Appendix A-1 and A-2).

Statistical Analysis. The comparison of the average numbers of phrases recalled in the Treatment Group and Control Group is computed by means of t test.

Results

Table 1 shows the t test on comparison of the average numbers of phrases recalled in the Treatment Group and Control Group. As can be seen, the t test indicated a significant difference between the Treatment Group and Control Group. Thus, it appears that significant capacity of short-term memory was enhanced in the Treatment Group because chunks of information were provided. 、

Table 1

t test on comparison of the average numbers of phrases recalled in the Treatment Group and Control Group

Group	M	Variance
Treatment Group (n=10)	10	10.889
Control Group (n=10)	7.3	4.011
df= 18 t(18)=2.212, p<.05		

Discussion

As indications in the literature, theorists proposed that the capacity of short-term memory could be extended through chunking information when one of the three conditions, sufficient time, attention, and well-established chunks of knowledge, is available (Ashcraft, 1994 & Barsalou, 1992). Obviously, experiment 1 shows that people can enhance their capacity of short-term memory as the information received is chunked in advance. Therefore, the present finding indicated that information chunked in advance could enhance subjects' capacity of short-term memory even though time is insufficient.

It is easily and common to find that students in Taiwan always complain that they have the problem of memorizing English vocabulary. For example, the amount of vocabulary in one unit is too much so that it is easily to be forgot. In fact, close examination of the English textbooks in Taiwan, you would find that words of vocabulary in each unit are seldom related, so it is difficult for students to do grouping. Thus, students often make great efforts to memorize words, but the performance is not as their expectation.

Since the present result shows that people can overcome the limitation of short-term memory through chunking in advance, what is the implication for language learning, especially in Taiwan? The suggestion is that each unit in the textbook should be edited in the light of topics and words of vocabulary should be related and arranged in groups so that students can easily remember them through chunking. For instance, a unit whose topic is cooking and vocabulary in the unit should include several categories such as appliances, gastronomy, flavoring and so on. Thus, in addition to assisting students' chunking information, it also enhances the possibility of students' memorizing many words of a unit in class according to the present finding and decreases the loading of the students on reviewing what they have learned after school.

In short, when the unit is edited in specific topic and the vocabulary provided could be classified or teachers group them based on some categories in advance, the loading of memorizing will be reduced due to the capacity of short-term memory is extended.

Experiment 2

The finding of experiment 1 has indicated an interesting and important implication, namely, if words or phrases of vocabulary in each unit in the textbook presented can be divided into several categories, then students can easily remember them through recording. In other words, compared with a unit organized in unrelated words, students can memorize more information in a unit whose words provided are much related while they are in class. Therefore, for the investigation of the implication of experiment 1, experiment 2 is conducted. The purpose of the experiment is to investigate whether a significant difference in the performance of students' recall exists in the Word-related Group and Word-unrelated Group.

Method

Participants. Twenty students with different majors in the remediation class of English in a technology university in Taiwan participated in the study. All the subjects were at the level of low language proficiency. They all had strong desire to improve their English, for they attend the remediation class voluntarily.

Procedure. The study included a Word-related Group and a Word-unrelated Group. In the Word-related Group, subjects were provided with an article whose vocabulary is related to a specific category, concerning the clothes. That is, most of the words or phrases presented in the vocabulary part were more related to clothes. As for the Word-unrelated group, the subjects were provided an article in which vocabulary presented does not focus on a certain category (see Appendix B-1 and B-2).

Two teachers participated in the present study. One was responsible for the Word-related Group; the other taught the subjects in the Word-unrelated Group. Because the type of the article was a piece of dialog, it was taught by means of conversations. Both teachers were told that all the vocabulary presented in the bottom of the article were taught first, but did not focus too much on those words, just on their pronunciations and Chinese meanings. And then, the content was performed through conversations. After the instruction, all the subjects were given a recall test (see Appendix C-1 and C-2) to measure how many words they have remembered through the previous conversations.

Materials. The two articles adopted in the experiment 2 were excerpted from "EZ Talk" in September, 2001, an English magazine (see Appendix B-1 and B-2).

Statistical Analysis. The comparison of the average numbers of phrases recalled in the Word-related Group and Word-unrelated Group was computed by means of t test.

Results

Table 2 presents t test on comparison of the average numbers of words recalled in the Word-related Group and Word-unrelated Group. As can be seen, the result showed that the difference between the Word-related Group and Word-unrelated Group was significant. Therefore, it seems that significant amount information of short-term memory was enhanced in the Word-related Group because the words or phrases presented in the article are around a certain category, subjects had the opportunity to chunk the information.

Table 2

t test on comparison of the average numbers of words recalled

in the Word-related Group and Word-unrelated Group

Group	M	Variance
Word-related Group (n=10)	12.7	2.011
Word-unrelated Group (n=10)	10.1	9.433
df= 18 t(18)=2.430, p<.05		

General Discussion

From the results of experiment 2, it is obvious that there is a strong relationship between short-term memory and language learning. In the experiment 1, subjects are provided with materials which are general words used in daily life. In addition, those materials are written in their mother language which they are familiar with. So, in their long-term memory, those materials has been organized well. Thus, when the subjects are presented with the chunked information, the well-established information stored in long-term memory will be activated (Barsalou, 1992). However, in the experiment 2, the subjects are all at the level of low language proficiency, most of words used in the article are new words or unfamiliar for them. There is still a significant difference between the Word-related Group and Word-unrelated Group. Obviously, the result implies that even though the subjects do not have well-established knowledge in their long-term memory, they still can hold more information than usual only when the information provided are relevant each other, which means that the subjects have the chance to chunk the information.

Due to the subjects' low language proficiency, the subjects are not required to write down what they have remembered, but to perform the recall through checking a word list. Although they do not actually write down what words they have recalled, the result seems to infer that they still benefit a lot from learning a word-related article. That is, when students keep more information in their mind, they will comprehend the upcoming content easily and quickly because less new words will hinder their understanding the content they read and when they review the words they

learned in class, they will memorize those words more easily. Therefore, the future research could be carried out to compare the effectiveness of students being taught vocabulary of a word-related article with vocabulary of a word-unrelated article. In addition, the subjects of the present study are too small, so the results may be different if much larger subjects participated in the study.

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Appendix A-1

The Word List Used in Control Group

空中小姐

襯衫

寶路

逃生門

頸圈

洋蔥

史奴比

飛機票

披薩

領帶

跳蚤

廚師

髮飾

雙子星

法國吐司

拖鞋

博美狗

巧克力

時差

絲襪

Appendix A-2

The Word List Used in Treatment Group

襯衫	法國吐司
拖鞋	披薩
絲襪	巧克力
領帶	洋蔥
髮飾	廚師
飛機票	史奴比
空中小姐	寶路
雙子星	博美狗
逃生門	狗頸圈
時差	跳蚤

Appendix B-1: The Article used in Word-related Group

Content

Jennifer: It's cold outside.

Billy: I know. That's why I'm wearing my new sweater tonight.

Jennifer: Billy, you're going to 1)burn up. I've got the 2)heater on.

Billy: But it's cold outside.

Jennifer: Billy, you need to learn to 3)layer.

Billy: Layer?

Jennifer: Yeah, you wear two to three layers.

Billy: Like a T-shirt, a 4)button-down shirt, and a 6)vast?

Jennifer: Sure! And then you could wear a 7)windbreaker 11)on top.

Billy: Sounds 13)complicated.

Jennifer: But the more layers you wear, the warmer you'll be.

Billy: And you can take off a layer or two when you're 12)indoors!

Jennifer: You've got the idea!

Billy: So what about you? What are you going to wear?

Jennifer: I'm going to wear my blue 8)tank top.

Billy: A tank up? But that's 5)sleeveless!

Jennifer: I know, but I have a 9)cardigan. And then I'll wear a miniskirt.

Billy: But your legs will freeze.

Jennifer: That's why I'll wear 10)leggings. I can take them off indoors!

Billy: So you're going to give us a show!

Jennifer: Don't get your hopes up, Billy.

Vocabulary

(1)	burn up 燒起來，燃燒	(8)	tank top 無袖上衣
(2)	heater 暖氣機	(9)	cardigan 羊毛衫
(3)	layer 分層疊放。此指衣服穿很多層，可以應天氣變化穿脫	(10)	leggings 緊身褲
(4)	button-down 有鈕扣可扣在襯衫上面的	(11)	on top 最外面的，最上面的
(5)	sleeveless 無袖的	(12)	indoors 在室內
(6)	vest 背心	(13)	complicated 複雜的
(7)	windbreaker 防風夾克，運動夾克		

Appendix B-2: The Article used in Word-unrelated Group

Content

Vera: Great! My cousin got tickets with a 1)budget travel place last year.

Craig: Oh, then maybe you want to use them.

Vera: No way! They closed shop and 2)ran off with his deposit money.

Craig: Ouch! 4)That had to hurt.

Vera: Let's just say it taught him to be a more 5)conscientious 6)consumer.

Craig: My brother's on the level. But, ladies, you need to know where you're going before you can get tickets.

Vera: I know where I want to go-two weeks in Hawaii! Beaches, boys, bars!

Vivian: Ooh, 7)tempting. But our boss will never let us both go for that long.

Vera: 8)Spoilsport. So what's your plan?

Vivian: Well, since I move here from the States, I've never been down south.

Vera: So we'll 9)compromise. We'll hit the Taiwan beaches.

Vivian: Deal! But can we stop in Tainan on the way for a little 10)sightseeing?

Vera: Sure! My family lives there. They'll 11)put us up for the night.

Vivian: Now I'm getting excited! Let's go by train so I can check out the sights!

Vera: Done. I think we should go down on a Wednesday.

Vivian: And 12)avoid the weekend 13)crowds! You're such a brain.

Vera: We'll definitely get seats on the train, too.

Vivian: I'll call Craig's brother for travel deals.

Vocabulary

(1)	budget 不貴的，便宜的	(8)	spoilsport 掃興的人
(2)	run off with 帶著……逃跑的	(9)	compromise 妥協
(3)	deposit 訂金	(10)	sightseeing 觀光
(4)	That bad to hurt. 真慘啊! 用來表示替人難過	(11)	ut....up 給…安排住宿
(5)	conscientious 謹慎的	(12)	avoid 逃避
(6)	consumer 消費者	(13)	crowds 人群
(7)	tempting 令人心動的		

Appendix C-1

The format of Recall Test for Word-related Group

Please circle words presented in the article.

burn up	white	leggings	short	vest
wear	indoors	sleeveless	room	walk
cardigan	weather	miniskirt	heater	shoe
windbreak	layer	hands	sweater	complicated
easy	hot	button-down	tank top	evening

Appendix C-2

The format of Recall Test for Word-unrelated Group

Please circle words presented in the article.

budget	clothes	compromise	road	check
sister	deposit	bus	consumer	good
crowds	put…up	stone	train	sightseeing
run up with	air	conscientious	tool	line
spoilsport	travel	there	avoid	tempting

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